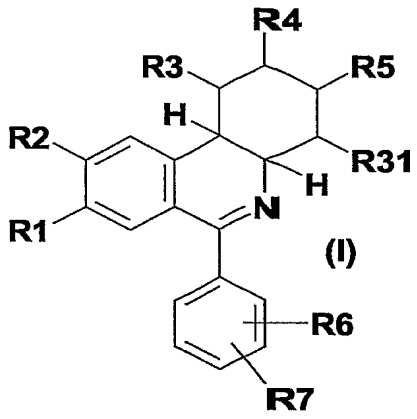
Patent Claims

1. Compounds of formula I



in which

R1 is hydroxyl, 1-4C-alkoxy, 3-7C-cycloalkoxy, 3-7C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1–4C-alkoxy,

R2 is hydroxyl, 1-4C-alkoxy, 3-7C-cycloalkoxy, 3-7C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1–4C-alkoxy,

or in which

R1 and R2 together are a 1-2C-alkylenedioxy group,

R3 is hydrogen or 1-4C-alkyl,

R31 is hydrogen or 1-4C-alkyl,

either, in a first embodiment (embodiment a) according to the present invention,

R4 is -O-R41, in which

R41 is hydrogen, 1-4C-alkyl, 1-4C-alkoxy-1-4C-alkyl, hydroxy-2-4C-alkyl, 1-7C-alkylcarbonyl, or completely or predominantly fluorine-substituted 1–4C-alkyl, and

R5 is hydrogen or 1-4C-alkyl,

or, in a second embodiment (embodiment b) according to the present invention,

R4 is hydrogen or 1-4C-alkyl, and

R5 is -O-R51, in which

R51 is hydrogen, 1-4C-alkyl, 1-4C-alkoxy-1-4C-alkyl, hydroxy-2-4C-alkyl, 1-7C-alkylcarbonyl, or completely or predominantly fluorine-substituted 1–4C-alkyl,

R6 is hydrogen, halogen, 1-4C-alkyl or 1-4C-alkoxy,

R7 is Het1, Het2, Har1, Het3 or Har2, in which

Het1 is optionally substituted by R71 and is a monocylic 3- to 7-membered fully saturated heterocyclic ring radical comprising one to three heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R71 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Het2 is optionally substituted by R72 and is a monocylic 5- to 7-membered saturated or unsaturated heterocyclic ring radical, which comprises one nitrogen atom and optionally one or two further heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, and to which ring one or two oxo substituents are bonded, in which

R72 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Har1 is optionally substituted by R73 and is a monocyclic 5-membered fully unsaturated heterocyclic ring radical comprising one to four heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R73 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Het3 is optionally substituted by R74 and is a monocyclic 5- or 6-membered partially unsaturated heterocyclic ring radical comprising one nitrogen atom and optionally one further heteroatom selected from the group consisting of nitrogen, oxygen and sulfur, in which

R74 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Har2 is optionally substituted by R75 and/or R76 and stands for a monocyclic 6-membered fully unsaturated heterocyclic ring radical comprising one to three nitrogen atoms, in which

R75 is 1-4C-alkyl, 1-4C-alkoxy, 1-4C-alkylthio, halogen, hydroxyl, amino, mono- or di-1-4C-alkylamino, or completely or partially fluorine-substituted 1-4C-alkyl,

R76 is 1-4C-alkoxy, 1-4C-alkylthio, hydroxyl, amino or mono- or di-1-4C-alkylamino,

and the salts, the N-oxides and the salts of the N-oxides of these compounds.

2. Compounds of formula I according to claim 1 in which

R1 is 1-2C-alkoxy, 3-5C-cycloalkoxy, 3-5C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R2 is 1-2C-alkoxy, 3-5C-cycloalkoxy, 3-5C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R3 is hydrogen,

R31 is hydrogen,

either, in a first embodiment (embodiment a) according to the present invention,

R4 is -O-R41, in which

R41 is hydrogen or 1-4C-alkylcarbonyl, and

R5 is hydrogen,

or, in a second embodiment (embodiment b) according to the present invention,

R4 is hydrogen, and

R5 is -O-R51, in which

R51 is hydrogen or 1-4C-alkylcarbonyl,

R6 is hydrogen, halogen, 1-4C-alkyl or 1-4C-alkoxy,

R7 is Het1, Het2, Har1, Het3 or Har2, in which

Het1 is optionally substituted by R71 and is a monocylic 3- to 7-membered fully saturated heterocyclic ring radical comprising one to three heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R71 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Het2 is optionally substituted by R72 and is a monocylic 5- to 7-membered saturated or unsaturated heterocyclic ring radical, which comprises one nitrogen atom and optionally one or two further heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, and to which ring one or two oxo substituents are bonded, in which

R72 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-4C-alkyl,

Har1 is optionally substituted by R73 and is a monocyclic 5-membered fully unsaturated heterocyclic ring radical comprising one to four heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R73 is 1-4C-alkyl, 1-4C-alkoxy, or completely or partially fluorine-substituted 1-4C-alkyl,

Het3 is optionally substituted by R74 and is a monocyclic 5- or 6-membered partially unsaturated heterocyclic ring radical comprising one nitrogen atom and optionally one further heteroatom selected from the group consisting of nitrogen, oxygen and sulfur, in which

R74 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-4C-alkyl,

Har2 is optionally substituted by R75 and/or R76 and stands for a monocyclic 6-membered fully unsaturated heterocyclic ring radical comprising one to three nitrogen atoms, in which

R75 is 1-4C-alkyl, 1-4C-alkoxy, 1-4C-alkylthio, halogen, hydroxyl, amino, mono- or di-1-4C-alkylamino, or completely or partially fluorine-substituted 1-4C-alkyl,

R76 is 1-4C-alkoxy, 1-4C-alkylthio, hydroxyl, amino or mono- or di-1-4C-alkylamino,

and the salts, the N-oxides and the salts of the N-oxides of these compounds.

3. Compounds of formula I according to claim 1 in which

R1 is 1-2C-alkoxy, 3-5C-cycloalkoxy, 3-5C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R2 is 1-2C-alkoxy, 3-5C-cycloalkoxy, 3-5C-cycloalkylmethoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R3 is hydrogen,

R31 is hydrogen,

R4 is -O-R41, in which

R41 is 1-4C-alkylcarbonyl or hydrogen,

R5 is hydrogen,

R6 is hydrogen,

R7 is Het1, Har1, Het3 or Har2, in which

Het1 is optionally substituted by R71 and is a monocylic 3- to 7-membered fully saturated heterocyclic ring radical comprising one nitrogen atom and optionally one or two further heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R71 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-4C-alkyl,

Har1 is optionally substituted by R73 and is a monocyclic 5-membered fully unsaturated heterocyclic ring radical comprising one nitrogen atom and optionally up to three further heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R73 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-4C-alkyl,

Het3 is optionally substituted by R74 and is a monocyclic 5-membered partially unsaturated heterocyclic ring radical comprising one nitrogen atom and one further heteroatom selected from the group consisting of nitrogen, oxygen and sulfur, in which

R74 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-4C-alkyl,

Har2 is optionally substituted by R75 and/or R76 and stands for a monocyclic 6-membered fully unsaturated heterocyclic ring radical comprising one or two nitrogen atoms, in which

R75 is 1-4C-alkyl, 1-4C-alkoxy, 1-4C-alkylthio, halogen, hydroxyl, amino, mono- or di-1-4C-alkylamino, or completely or partially fluorine-substituted 1-4C-alkyl,

R76 is 1-4C-alkoxy, 1-4C-alkylthio, hydroxyl, amino or mono- or di-1-4C-alkylamino,

and the salts, the N-oxides and the salts of the N-oxides of these compounds.

4. Compounds of formula I according to claim 1 in which

R1 is 1-2C-alkoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R2 is 1-2C-alkoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R3 is hydrogen,

R31 is hydrogen,

R4 is -O-R41, in which

R41 is hydrogen,

R5 is hydrogen,

R6 is hydrogen,

R7 is Het1, Har1, Het3 or Har2, in which

Het1 is pyrrolidin-1-yl, piperidin-1-yl, morpholin-4-yl or thiomorpholin-4-yl, or 4-N-(R71)-piperazin-1-yl or 4-N-(R71)-homopiperazin-1-yl, in which

R71 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Har1 is optionally substituted by R73 and is a monocyclic 5-membered fully unsaturated heterocyclic ring radical comprising one nitrogen atom and optionally up to three further heteroatoms selected independently from the group consisting of nitrogen, oxygen and sulfur, in which

R73 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Het3 is 1-N-(R74)-4,5-dihydro-1H-imidazol-2-yl, in which

R74 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Har2 is optionally substituted by R75 and/or R76 and stands for a monocyclic 6-membered fully unsaturated heterocyclic ring radical comprising one or two nitrogen atoms, in which

R75 is 1-2C-alkyl, 1-4C-alkoxy, mono- or di-1-2C-alkylamino, or completely or partially fluorine-substituted 1-2C-alkyl,

R76 is 1-4C-alkoxy or mono- or di-1-2C-alkylamino,

and the salts, the N-oxides and the salts of the N-oxides of these compounds.

5. Compounds of formula I according to claim 1 in which

R1 is 1-2C-alkoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R2 is 1-2C-alkoxy, 2,2-difluoroethoxy, or completely or predominantly fluorine-substituted 1-2C-alkoxy,

R3 is hydrogen,

R31 is hydrogen,

R4 is -O-R41, in which

R41 is hydrogen,

R5 is hydrogen,

R6 is hydrogen,

R7 is Het1, Har1, Het3 or Har2, in which

Het1 is pyrrolidin-1-yl, piperidin-1-yl, morpholin-4-yl or thiomorpholin-4-yl, or 4-N-(R71)-piperazin-1-yl or 4-N-(R71)-homopiperazin-1-yl, in which

R71 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Har1 is optionally substituted by R73 and is pyrrolyl, imidazolyl, pyrazolyl, 1,2,4-triazolyl, tetrazolyl, oxazolyl, thiazolyl, 1,2,3-thiadiazolyl, 1,2,4-oxadiazolyl or 1,3,4-oxadiazolyl, in which

R73 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Het3 is 1-N-(R74)-4,5-dihydro-1H-imidazol-2-yl, in which

R74 is 1-4C-alkyl, or completely or partially fluorine-substituted 1-2C-alkyl,

Har2 is optionally substituted by R75 and/or R76 and is pyridinyl or pyrimidinyl, in which

R75 is 1-4C-alkoxy,

R76 is 1-4C-alkoxy,

and the salts, the N-oxides and the salts of the N-oxides of these compounds.

6. Compounds of formula I according to claim 1 in which

one of R1 and R2 is methoxy, and the other is methoxy, ethoxy, difluoromethoxy or 2,2-difluoroethoxy, and

R3 and R31 are both hydrogen,

R4 is -O-R41, in which

R41 is hydrogen,

R5 is hydrogen,
R6 is hydrogen,
R7 is Het1, Har1 or Har2, in which
Het1 is morpholin-4-yl or 4-N-(R71)-piperazin-1-yl, in which
R71 is 1-4C-alkyl;
Har1 is optionally substituted by R73 and is 2H-tetrazol-5-yl, 1,2,3-thiadiazol-4-yl, imidazol-1-yl, thiazol-4-yl, oxazol-5-yl, 1,2,4-triazol-1-yl, or 1,2,4-oxadiazol-3-yl, in which
R73 is 1-4C-alkyl,
such as, for example, 2-(1-4C-alkyl)-2H-tetrazol-5-yl such as e.g. 2-propyl-2H-tetrazol-5-yl or 2-ethyl-2H-tetrazol-5-yl, 1,2,3-thiadiazol-4-yl, imidazol-1-yl, 2-(1-4C-alkyl)-thiazol-4-yl such as e.g. 2-methyl-thiazol-4-yl, oxazol-5-yl, 1,2,4-triazol-1-yl, or 5-(1-4C-alkyl)-1,2,4-oxadiazol-3-yl such as e.g. 5-methyl-1,2,4-oxadiazol-3-yl;
Har2 is optionally substituted by R75 and/or R76 and is pyridinyl or pyrimidinyl, in which
R75 is 1-4C-alkoxy,
R76 is 1-4C-alkoxy,
such as, for example, 4,6-dimethoxy-pyrimidin-2-yl;
and the salts, the N-oxides and the salts of the N-oxides of these compounds.

7. Compounds of formula I according to claim 1 in which
R1 is methoxy, or ethoxy,
R2 is methoxy, ethoxy, difluoromethoxy, or 2,2-difluoroethoxy,
R3 is hydrogen,
R31 is hydrogen,
R4 is -O-R41, in which
R41 is hydrogen,
R5 is hydrogen,
R6 is hydrogen,
R7 is bonded to the meta or para position with respect to the binding position in which the phenyl ring is bonded to the phenanthridine ring system, and is Het1, Har1 or Har2, in which

Het1 is morpholin-4-yl or 4-N-(R71)-piperazin-1-yl, in which
R71 is methyl;

Har1 is 2-(1-4C-alkyl)-2H-tetrazol-5-yl such as e.g. 2-propyl-2H-tetrazol-5-yl or 2-ethyl-2H-tetrazol-5-yl, 1,2,3-thiadiazol-4-yl, imidazol-1-yl, 2-methyl-thiazol-4-yl, oxazol-5-yl, 1,2,4-triazol-1-yl, or 5-methyl-1,2,4-oxadiazol-3-yl;

Har2 is optionally substituted by R75 and/or R76 and is pyridinyl or pyrimidinyl, in which
R75 is methoxy,

R76 is methoxy,
such as, for example, 4,6-dimethoxy-pyrimidin-2-yl;

and the enantiomers, as well as the salts, the N-oxides and the salts of the N-oxides of these compounds and enantiomers.

8. Compounds of formula I according to any of the preceding claims comprising one or more of the following:
R1 is methoxy or ethoxy,
R2 is methoxy, ethoxy, difluoromethoxy or 2,2-difluoroethoxy, and
R3 and R31 are both hydrogen; and

R4 is -O-R41, in which
R41 is hydrogen, or 1-4C-alkylcarbonyl such as e.g. acetyl, and
R5 is hydrogen;
and the salts, the N-oxides and the salts of the N-oxides of these compounds.

9. Compounds of formula I according to any of the preceding claims comprising one or more of the following:
R1 is methoxy,
R2 is ethoxy, difluoromethoxy or 2,2-difluoroethoxy, and
R3 and R31 are both hydrogen;

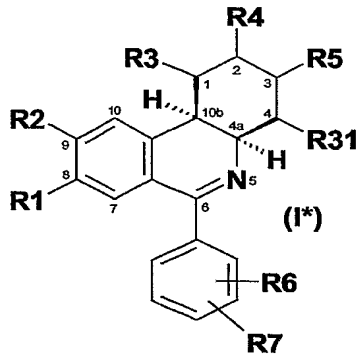
R4 is -O-R41, in which
R41 is hydrogen, and
R5 is hydrogen; and

R7 is Har2, in which
Har2 is optionally substituted by R75 and/or R76, and is pyridinyl or pyrimidinyl;
and the salts, the N-oxides and the salts of the N-oxides of these compounds.

10. Compounds of formula I according to claim 1 selected from
(2RS,4aRS,10bRS)-9-Ethoxy-6-(4-imidazol-1-yl-phenyl)-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-Ethoxy-8-methoxy-6-[4-(4-methyl-piperazin-1-yl)-phenyl]-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-6-[4-(4,6-Dimethoxy-pyrimidin-2-yl)-phenyl]-9-ethoxy-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,

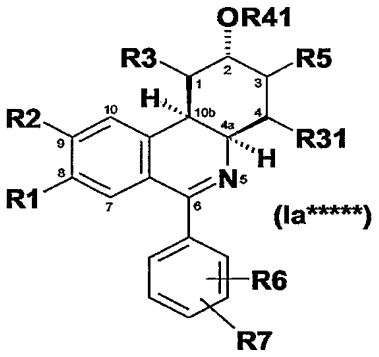
(2RS,4aRS,10bRS)-9-Ethoxy-8-methoxy-6-(4-[1,2,3]thiadiazol-4-yl-phenyl)-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-Ethoxy-8-methoxy-6-(4-morpholin-4-yl-phenyl)-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-8,9-Dimethoxy-6-[4-(2-propyl-2H-tetrazol-5-yl)-phenyl]-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-8-(1,1-Difluoro-methoxy)-6-[4-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-9-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(1,1-Difluoro-methoxy)-6-[4-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(2,2-Difluoro-ethoxy)-8-methoxy-6-[3-(2-methyl-thiazol-4-yl)-phenyl]-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(2,2-Difluoro-ethoxy)-6-[4-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(2,2-Difluoro-ethoxy)-8-methoxy-6-(4-oxazol-5-yl-phenyl)-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(2,2-Difluoro-ethoxy)-8-methoxy-6-(4-[1,2,4]triazol-1-yl-phenyl)-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-(2,2-Difluoro-ethoxy)-6-(4-imidazol-1-yl-phenyl)-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-Ethoxy-8-methoxy-6-[3-(5-methyl-[1,2,4]oxadiazol-3-yl)-phenyl]-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-Ethoxy-8-methoxy-6-[4-(5-methyl-[1,2,4]oxadiazol-3-yl)-phenyl]-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2RS,4aRS,10bRS)-9-Ethoxy-6-[3-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2R,4aR,10bR)-9-Ethoxy-6-(4-imidazol-1-yl-phenyl)-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2S,4aS,10bS)-9-Ethoxy-6-(4-imidazol-1-yl-phenyl)-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2R,4aR,10bR)-9-Ethoxy-6-[3-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol,
(2R,4aR,10bR)-9-(2,2-Difluoro-ethoxy)-6-[4-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-2-ol, and
3SR,4aRS,10bRS)-9-Ethoxy-6-[3-(2-ethyl-2H-tetrazol-5-yl)-phenyl]-8-methoxy-1,2,3,4,4a,10b-hexahydro-phenanthridin-3-ol,
the enantiomers, as well as the salts, the N-oxides and the salts of the N-oxides of these compounds and enantiomers.

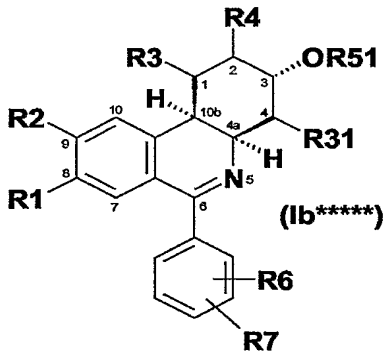
11. Compounds of formula I according to any of the preceding claims, which have with respect to the positions 4a and 10b the configuration shown in formula I*:



and the salts, the N-oxides and the salts of the N-oxides of these compounds.

12. Compounds of formula I according to any of the preceding claims, which have with respect to the positions 2, 4a and 10b the configuration shown in formula Ia*****, or, which have with respect to the positions 3, 4a and 10b the configuration shown in formula Ib*****:





and the salts, the N-oxides and the salts of the N-oxides of these compounds.

13. Compounds of formula I as claimed in claim 1 for use in the treatment of diseases.

14. A pharmaceutical composition comprising one or more compounds of formula I as claimed in claim 1 together with customary pharmaceutical excipients and/or vehicles.

15. The use of compounds of formula I as claimed in claim 1 for the production of pharmaceutical compositions for treating respiratory disorders.

16. A method for treating illnesses in a patient comprising administering to said patient a therapeutically effective amount of a compound of formula I as claimed in claim 1.

17. A method for treating airway disorders in a patient comprising administering to said patient a therapeutically effective amount of a compound of formula I as claimed in claim 1.